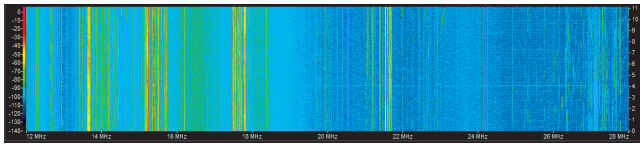
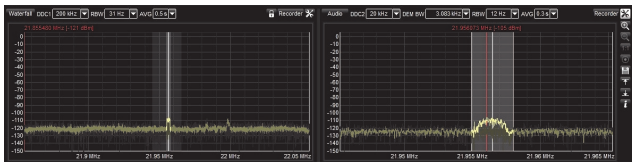
W-CODE

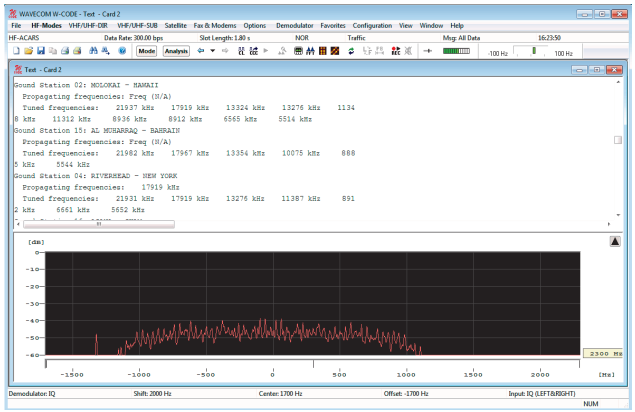
Standard Decoder Software

WAVECOM
Brochure 2012

W-CODE provides all functions required to classifiy, analyze, record, decode and process radio data communications throughout the full radio spectrum from HF to SHF.







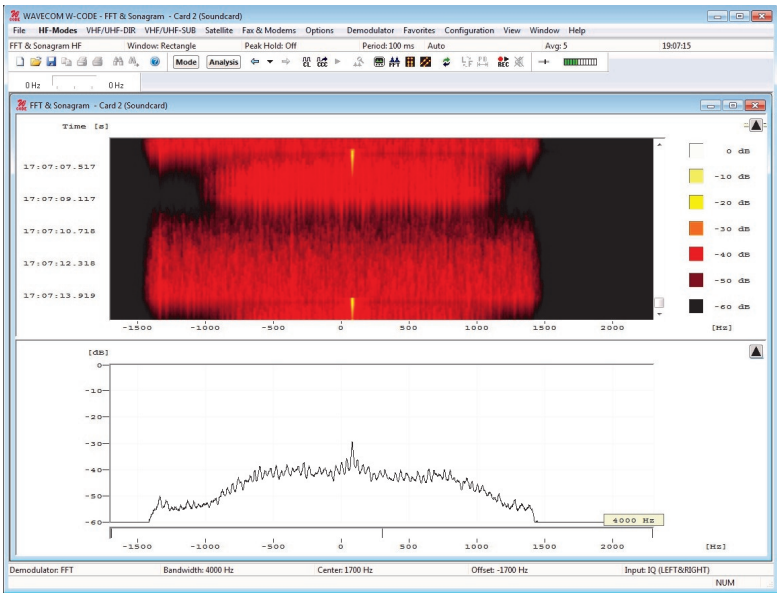
W-CODE FEATURES

- Automatic classification, code check, demodulation and decoding to content level of known signals
- Automatic classification and code check of unknown, predefined signals
- Signal overview using real-time spectrum, waterfall displays and manual signal measurements
- Supports SDR (Software Defined Radio) I/Q data or digital input
- Supports TCP/IP input streams using IP-CONF, IP-PxGF, VITA-49, Virtual Audio Cable (VAC), WiNRadio Digital Bridge Virtual Sound Card (VSC) and built-in Sound card input with sampling rates of up to 192 kHz
- Tested with a number of SDRs, e.g. WinRadio WR-G39DDC, Grintek GRXLAN, Perseus, netSDR, SDR-IP, Rohde & Schwarz and MEDAV LR2.
- Supports direct input and output of WAV files with integrated Wavecom Media Player/Recorder
- Decoded output can be saved to files or transferred to an external application using the XML remote control interface

W-CODE FUNCTIONS

The decoder can be used in a number of configurations:

- Local use as a PC application
- Remote use via LAN with standard W-CODE application instances in client-server mode
- Remote control from other applications using third party software (using TCP/IP and XML)
- Remote control via Microsoft Remote Desktop Protocol



The easy-to-use graphical user interface (GUI) with well-structured pull-down menus allows an operator to rapidly become familiar with W-CODE. A high degree of operator proficiency can quickly be achieved.

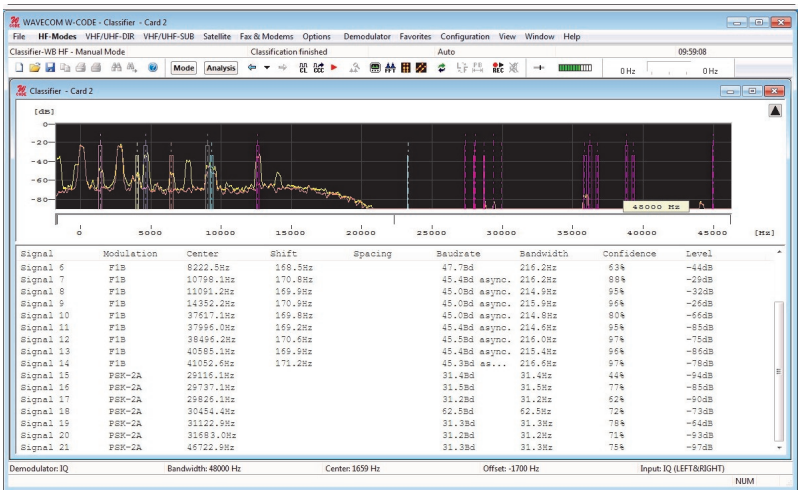
The implementation of complex systems for monitoring is limited only by the number of decoders and the performance of the hardware and software. A wide range of system default settings can be configured, e.g., input signal level, measuring interval, center frequency and demodulator type.

System components can be individually configured according to the requirements of the customer. A wide range of system default settings can be configured, e.g., input signal level, measuring interval, center frequency and demodulator type.

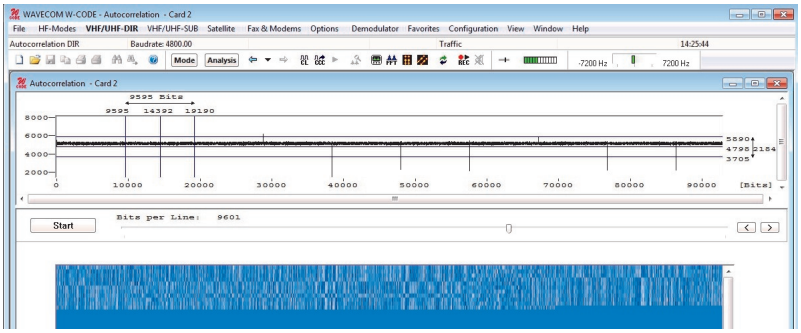
A W-CODE decoder may be controlled from anywhere across the network, and its output can be sent to one or more applications on the network. An integrated remote control interface allows easy control of W-CODE from a customer application.

W-CODE OPTIONS

- Narrowband Classifier (CL-NB) - Automatic signal classification within an 8 kHz bandwidth and code check of known and unknown signals
- Wideband Classifier (CL-WB) - Automatic signal classification within a 96 kHz bandwidth and code check of known and unknown signals



Wideband Classifier-Code-Check (CCC)



Autocorrelation of a 4800 bps signal correlating at 9600 bits

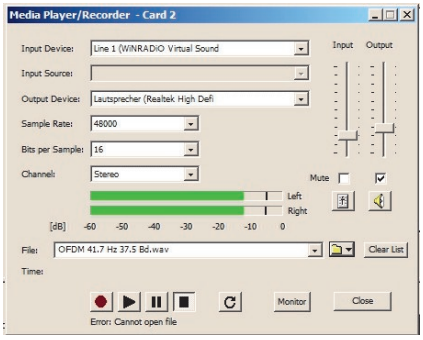
W-CODE ANALYSIS

The determination of signal characteristics is assisted by a large number of analysis and measurement functions. The numerous integrated analysis tools contain several different methods and viewing options.

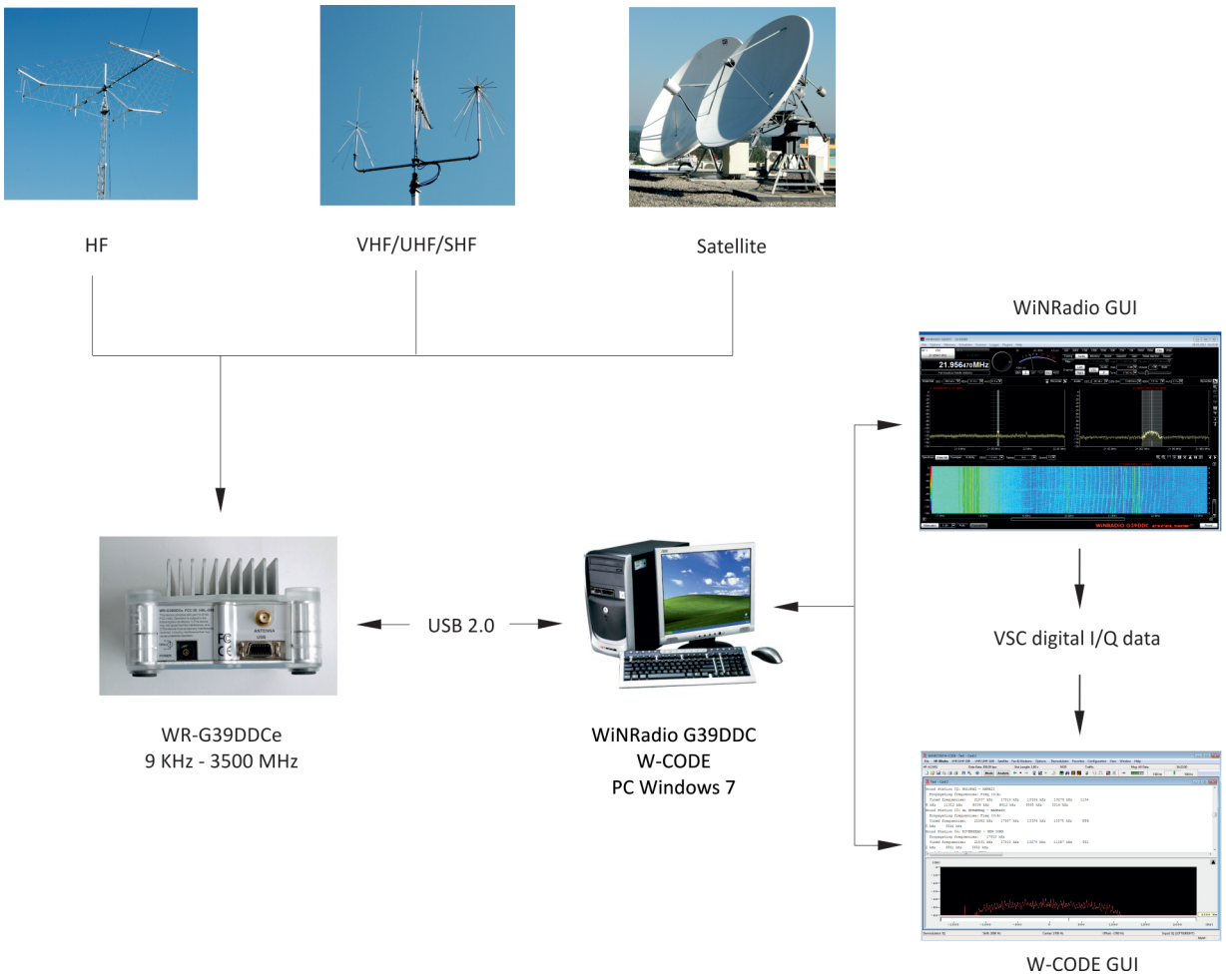
FFT Sonagram FFT & Sonagram Waterfall Oscilloscope
FSK Analysis FSK Code Check
PSK Symbol Rate PSK Phase Plane PSK Code Check MIL-STANAG Code Check
MFSK Analysis MFSK Code Check
Classifier Classifier Code Check
Autocorrelation Bit Correlation Bit Length Analyis
Demodulated bitstream

W-CODE RECORDER

This tool directly records signals from the selected input to digital WAV files. During playback of WAV files the signal is sent unprocessed to W-CODE and a monitoring signal is played back through the host sound card.

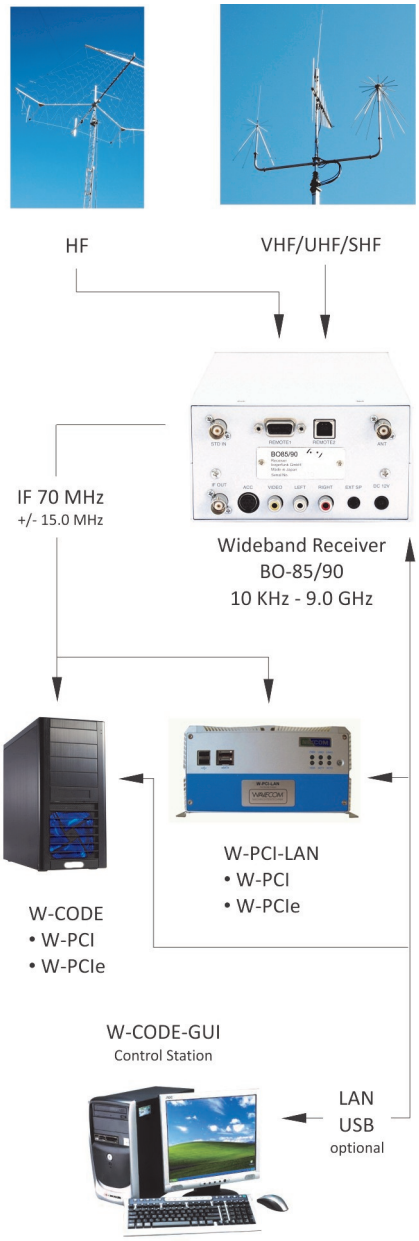


The GUI assists the operator in analyzing the important signal parameters. Dynamic zoom functions allow magnification of details in any selected window and the scroll buffering feature makes it possible to move back and forward in time over the input signal.

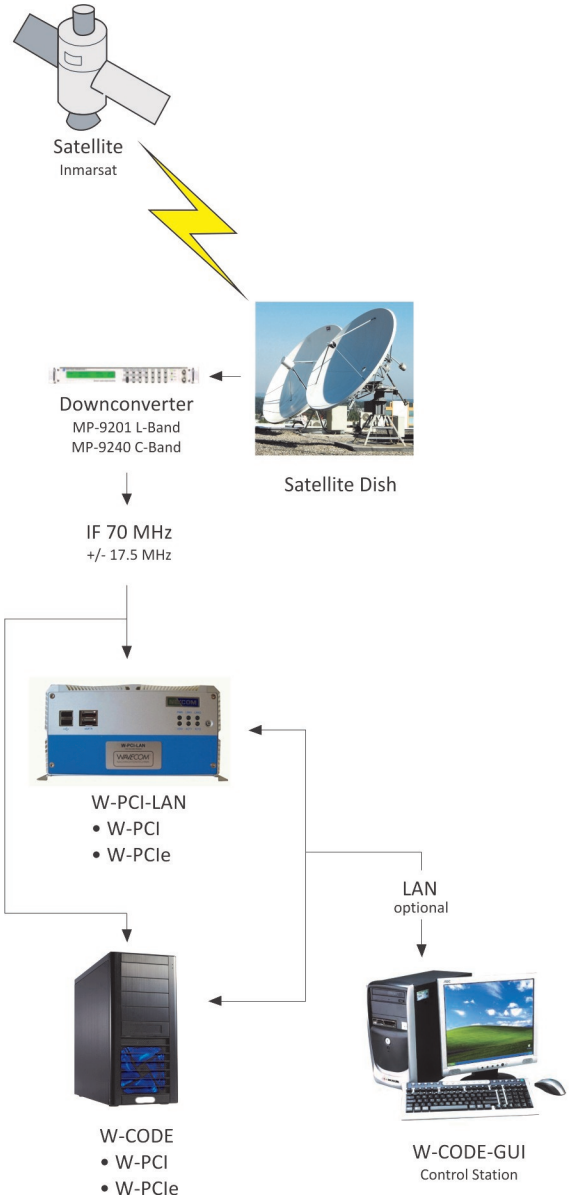


A W-CODE and WiNRadio SDR configuration

W-CODE accepts input from the host built-in sound card, a number of SDRs, digital audio outputs, WAV files, I/Q data or TCP/IP streams.
W-CODE provides all functions required to analyze, decode and process radio data communications throughout the radio spectrum from HF, VHF, UHF to SHF.



W-CODE and wideband receiver configuration



Basic satellite monitoring station

HF - Protocols

- ALE-400
- ALF-RDS
- ALIS
- ALIS-2
- ARQ6-90
- ARQ6-98
- ARQ-E
- ARQ-E3
- ARQ-M2-242
- ARQ-M2-342
- ARQ-M4-242
- ARQ-M4-342
- ARQ-N
- ASCII
- AUM-13
- AUTOSPEC
- BAUDOT
- BR-6028 (ITA-2 and ITA-5)
- BULG-ASCII
- CHU
- CIS-11
- CIS-12 (HEX output)
- CIS-14
- CIS-36
- CIS-36-50
- CIS-50-50
- CLOVER-2 (ARQ, all CRCs)
- CLOVER-2000 (ARQ, all CRCs)
- CODAN-SELCAL
- CODAN-9001
- COQUELET-13
- COQUELET-8
- COQUELET-80
- CV-786
- CW-MORSE
- DCS SELCAL
- DGPS
- DUP-ARQ
- DUP-ARQ-2
- DUP-FEC-2
- EFR
- FEC-A
- FELDHELL
- FM-HELL
- GMDSS/DSC-HF
- G-TOR
- GW-FSK
- GW-OFDM
- GW-PSK
- HC-ARQ
- HF-ACARS (HF-DL)
- HNG-FEC
- ICAO-SELCAL (ANNEX 10)
- LINK-11 (CLEW)
- MD-674
- MFSK-16
- MFSK-20
- MFSK-8
- MIL-188-110-16TONE (-110A/B App. A)
- MIL-188-110-39TONE (-110A/B App. B)
- MIL-188-110A Serial Tones, 75-4800 bps
- MIL-188-110B (App. C) STANAG 4539
- MIL-188-110B 3200-12800 bps
- MIL-188-141A (ALE)
- MIL-188-141B (BW0, BW1, BW4 data)
- MIL-188-141B (BW2, BW3 ID)
- MIL-M-55529 NB/WB
- OLIVIA
- PACKET-300/600
- PACTOR (all CRCs)
- PACTOR-FEC (all CRCs)
- PACTOR-II (all CRCs)
- PACTOR-II-AUTO (all CRCs)
- PACTOR-II-FEC (all CRCs)
- PACTOR-III (all CRCs)
- PICCOLO-MK12
- PICCOLO-MK6
- POL-ARQ
- PRESS-FAX
- PSK-10
- PSK-125 (BPSK, QPSK) with FLARC
- PSK-125F
- PSK-220F
- PSK-250 (BPSK, QPSK) with FLARC
- PSK-31 (BPSK, QPSK)
- PSK-31-FEC
- PSK-63 (BPSK, QPSK) with FLARC
- PSK-63F
- PSK-AM
- ROBUST-PACKET
- RUM-FEC
- SI-AUTO
- SI-ARQ
- SI-FEC
- SITOR-AUTO
- SITOR-ARQ
- SITOR-FEC
- SP-14
- SPREAD-11, 21, 51
- SSTV Automatic
- SSTV Martin 1, 2, 3, 4
- SSTV Robot 8s, 12s, 24s ,36s
- SSTV SC-1 16, 32s
- SSTV SC-1 8s, 16s, 32s
- SSTV Scottie 1, 2, 3, 4
- SSTV Wraase SC-1 24s - 96s
- SSTV Wraase SC-2 20s - 180s
- STANAG 4285 75-3600 bps
- STANAG 4415 75 bps (NATO ROBUST)
- STANAG 4481-FSK (KG-84)
- STANAG 4481-PSK
- STANAG 4529 75-1800 bps
- STANAG 4539 3200-12800 bps
- STANAG 5065-FSK
- SWED-ARQ
- TWINPLEX
- VISEL
- WEATHER-FAX

Advanced HF - Protocols

GW-OFDM is used by GlobeWireless® which owns and operates coastal stations world-wide connected by leased lines to two, redundant network operation centers in Liverpool, UK and San Francisco, USA. The company offers fully automatic HF and satellite systems to more than 4,000 vessels worldwide.

GW-OFDM (Orthogonal Frequency Division Multiplex) uses long packets for payload data and short packets for control or request information for the ARQ process. The Information Sending Station (ISS) exchanges information with an Information Receiving Station (IRS) in half-duplex on a pair of frequencies. A data scrambler is used to reduce the high peak-to-average-power ratio which is a characteristic of OFDM systems.

The main parameters of GW's adaptation of OFDM are:

- 12 to 32 subcarriers dynamically assigned
- DQPSK modulation
- 62.5 Hz subcarrier spacing
- Symbol rate 62.5, duration 16 ms
- Guard interval duration 2 ms
- 700-2700 Hz occupied bandwidth
- Pilot tone for synchronization and frequency tracking

LINK-11, also known in the USA as TDL A and previously as TADIL A, is a NATO standard for transmission of tactical data over radio. Data is exchanged using the Conventional Link Eleven Waveform (CLEW) - a differential quadrature phase-shift modulated data link operating at a rate of 1364 bps (HF, UHF) or 2250 bps (UHF). Since SLEW is susceptible to ECM, a recent addition to the standard has been the Single Tone Link Eleven Waveform (SLEW), which using single tone M-ary PSK disperses data bit errors uniformly utilizing data interleaving and Full Tail Biting Convolutional Block (FTBCB) encoding. The better ECM resistance allows a data rate of 1800 bps.

ROBUST-PACKET (RPR) is optimized for deployment in the short wave band. To accommodate the characteristics of this frequency range, e.g. fading and multipath propagation resulting in intersymbol interference, eight-carrier, pulse-shaped OFDM is used. The AF center frequency is 1500 Hz and the carrier center spacing is 60 Hz. Dependent on the user data rate (200 or 600 bps excluding AX.25 protocol overhead) each carrier is DBPSK or DQPSK modulated at a constant rate of 50 Baud. The WAVECOM decoder automatically detects the user data rate and the size of the transmitted packets.

PACTOR-III is an adaptive transmission mode that provides higher throughput and improved robustness compared to PACTOR-I and PACTOR-II.

CLOVER-2 is an adaptive modulation system with ARQ and FEC (broadcast) modes. It uses Reed-Solomon (RS) coding to achieve a remarkable performance even under poor HF propagation conditions.

CLOVER-2000 is another adaptive modulation system of the CLOVER family and offers ARQ with Reed-Solomon (RS) coding to achieve a remarkable performance even under the worst HF propagation conditions.

CODAN-9001 is an asynchronous adaptive ARQ system. The Wavecom decoder supports these functions:

- Automatic recognition of secure and unsecure modes
- De-randomization of secure an unsecure mode
- Arbitrary start values for de-randomization
- Output of recognized start value in secure mode
- Output of status information
- Output of recognized frame type
- Decoding of chat messages into text
- Decoding of text file transmissions into readable output
- Decoding of data transmissions into hexadecimal output
- Decompression of data
- Storage of channel data for analysis purposes
- 7-bit ASCII alphabet used by CODAN-9102 software

VHF/UHF - Protocols

ACARS	DZVEI (Selcal analog)	PACKET-1200
AIS	EEA (Selcal analog)	PACKET-9600
APCO-25 (P25)	EIA (Selcal analog)	PCCIR (Selcal analog)
ASCII	ERMES	PDZVEI (Selcal analog)
ATIS (Selcal digital)	EURO (Selcal analog)	POCSAG
BIIS	FLEX	PZVEI (Selcal analog)
CCIR-1 (Selcal analog)	FMS-BOS (Selcal digital)	SKYPER (POCSAG)
CCIR-2 (Selcal analog)	GMDSS/DSC-VHF	TETRA (with live voice)
CCIR-7 (Selcal analog)	GOLAY/GSC	VDEW (Selcal analog)
CCITT (Selcal analog)	MOBITEX-1200 (with OVLS)	VDL-M2
CTCSS	MOBITEX-8000	X.25
DCS-SELCAL	MODAT (Selcal analog)	ZVEI-1 (Selcal analog)
DGPS	MPT-1327 (with ITA-5)	ZVEI-2 (Selcal analog)
DMR (with live voice)	NATEL (Selcal analog)	ZVEI-3 (Selcal analog)
dPMR (with live voice)	NMT-450	ZVEI-VDEW (Selcal digital)
DTMF (Selcal analog)	NWR-SAME	

SATELLITE - Protocols

AMSAT-P3-D	INMARSAT-B-TELEX-MM (forward)	INMARSAT-M-FAX (forward)
INMARSAT-AERO-P (beta)	INMARSAT-B-TELEX-SM (forward)	INMARSAT-M-TEL (forward, with live voice)
INMARSAT-B-C-TFC (return)	INMARSAT-C-EGC (Enhanced Group Call)	INMARSAT-mM-DATA (forward)
INMARSAT-B-Data (forward)	INMARSAT-C-TDM	INMARSAT-mM-FAX (forward)
INMARSAT-B-FAX (forward)	INMARSAT-C-TDM-EGC	INMARSAT-mM-TEL (forward)
INMARSAT-B-HSD (forward, high speed data)	INMARSAT-C-TDMA	NOAA-GEOSAT
INMARSAT-B-TEL (forward, with live voice)	INMARSAT-M-DATA (forward)	ORBCOMM

FAX-G3 and MODEM - Protocols

FAX-G3 T4 / T6 / JPEG / JBIG T.30 protocol with ECMM	BELL103	V.26 / V.26bis
FAX-G3-V.17	BELL212A	V.32 / V.32bis
FAX-G3-V.27ter	V.21	V.34 / V.34bis
FAX-G3-V.29	V.22 / V.22bis	V.90
FAX-G3-V.34hdx	V.23	V.92

Advanced VHF and UHF Protocols

TETRA (Terrestrial Trunked Radio, ETSI EN 300 392-2) is a digital, trunked mobile radio standard for voice and data developed by ETSI. TETRA was designed using the experience gained from GSM and from several trunked radio systems. It provides various security measures including authentication mechanisms, air interface encryption and end-to-end encryption. TETRA has found widespread use all over Europe and also outside the EU in public safety, transportation, military and general land mobile applications.

APCO-25, P25 or Project 25 is a set of standards for radio communications for public safety, security, public service and commercial applications developed among others by the Association of Public Safety Communications Officials International (APCO). It is standardized by the US Telecommunications Industry Association (TIA) and supports both voice and data transmissions. P25 compliant radios can communicate in analog mode with non-P25 radios and in analog and digital mode with P25 radios.

DMR - In the ever ongoing effort to squeeze more capacity out of a finite resource, the electromagnetic spectrum, a new digital standard, Digital Mobile Radio (DMR, ETSI TS 102-361) is emerging. Whereas the older analogue PMR (Private Mobile Radio) systems require 25 kHz channels or for newer systems 12.5 kHz, DMR offers two channels within 12.5 kHz. DMR offers both voice and data communications and interfacing to external networks. Voice communications offer features as call alert, emergency call, remote monitoring, silent worker, Push-to-Talk ID, radio check, all call, stunning etc.

dPMR is an open ETSI standard published in TS 102 490 (license-free) and TS 102 658 (licensed). TS 102 490 covers license-free hand portable equipment operating in peer-to-peer mode. The radios have an integral antenna and limited output power. The standard is also known as dPMR446. dPMR offers two discrete frequency channels within 12.5 kHz FDMA (Frequency Division Multiple Access) and voice as well as data communications.

VDL-M2 - For many years, ACARS has been the only mode for air-ground/ground-air VHF data communications. However, global increase in air travel as well as the demand for bandwidth hungry data applications has also led to an increase in the demand for aeronautical VHF communication channels. ACARS is also constrained to 7-bit character oriented data, whereas VDL-M2 natively is bit oriented. To comply with this demand, aeronautical voice channel bandwidth has been decreased to 8.33 kHz. One result of these considerations has been the introduction of VHF Data Link Mode 2 (VDL Mode 2) which is planned to eventually replace ACARS.

MOBITEX-8000 utilizes a hierarchical switching architecture with a top level main exchange through which all national traffic is switched. Regional exchanges connect to the main exchange and are in turn connected to area exchanges. Fixed terminals and external gateways for exchange of traffic with the Internet, PSTN, GSM-SMS etc. are connected to the area exchanges as are the base stations. At the lowest level of the switching hierarchy mobile terminals connect to the base stations. Traffic between mobiles connected to the same base station will be switched there, the principle being to switch at the lowest possible level. By using this architecture, unnecessary traffic load is removed from the trunks, and a high degree of autonomy and resilience is ensured even if the higher level links are not operational. Mobitex 8000 is only enabled for data and uses 8000 bps GMSK modulation.

BIIS (**B**inary **I**nterchange of **I**nformation and **S**ignaling) is a data mode standardized by ETSI TS 300-230. The standard only describes the air interface, i.e. the physical layer, the data link layer and a call control layer. BIIS functionality includes selective calling, various other call features, short text messaging, predefined status messages and data transmission.

Alphabets

Chinese (7-bit ASCII)	ITA-2 Swedish	Morse Arabic
HEX	ITA-2 TASS Cyrillic	Morse Cyrillic
ITA-1 Latin	ITA-2 Third Shift Cyrillic	Morse Greek
ITA-2 Baghdad70 Arabic	ITA-2 Third Shift Greek	Morse Hebrew
ITA-2 Baghdad80 Arabic	ITA-5 Bulgarian	Morse Latin
ITA-2 Cyrillic	ITA-5 Danish-Norwegian	Morse Scandinavian
ITA-2 Danish-Norwegian	ITA-5 French	Morse Spanish
ITA-2 Hebrew	ITA-5 German	User defined 5-bit alphabets based on UNICODE
ITA-2 Latin	ITA-5 Swedish	
ITA-2 Latin Transparent	ITA-5 US	

Demodulators (Bit error rate within 3 dB of theoretical value, white Gaussian noise, non-fading channel)

AM for METEOSAT and NOAA-GEOASAT FAX transmissions	FFSK, 10-12000 Baud, Shift 50 Hz-16 kHz
BPSK, 10-12000 symbols/s	FSK, 10-2400 Baud, Shift 50 Hz-3.5 kHz Center freq. 0.5 kHz-3.5 kHz
CTCSS	GFSK, 10-12000 Baud, Shift 50 Hz-16 kHz
CW Morse, 10-500 WPM, center freq. 0.5 kHz-3.5 kHz BW 100 Hz-1.2 kHz, AFC On/Off	Mark-Space FSK, 10-300 Baud, Shift 50 Hz-3.5 kHz Center freq. 0.5 kHz-3.5 kHz
DPSK, DBPSK, DQPSK, D8PSK, D16PSK, 10-12000 symbols/s	MFSK, Tone length 4-1000 ms, max. 64 Tones Shift 50 Hz-3.5 kHz
DTMF	OFDM, 12-32 carriers, DQPSK, 62.5 symbols/s
DXPSK, dual carrier adaptive modulation, 2DPSK-D16PSK, 100 Baud	OQPSK, 10-12000 symbols/s
FAX-G3-V.17, FAX-G3-V.27ter, FAX-G3-V.29 FAX-G3-V.34hdx,	QPSK, 10-12000 symbols/s
BELL103, BELL212A, V.21, V.22/V22bis, V.23 V.26/V26bis, V.32 / V.32bis, V.34, V.90, V.92	Software AM/FM demodulator for IF inputs

Classifier Code Check (CCC) with look-up table and XML-editor for all modulation variants

Process Steps	P1	Only classification is performed, but no decoding
	P2	Classification and table check are performed, but no decoding
	P3	Classification, table check and code check are performed, but no decoding
	P4	Classification and table check are performed and finally the signal is decoded if a mode with an associated, valid detector was found
	P5	Classification, table check and code check are performed and finally the signal is decoded if a mode with an associated, valid detector was found

Analysis Functions

- Autocorrelation up to 200.000 bits
- Automatic analysis and decoding software for all data and FAX-G3 modulation types
- Automatic CRC recognition of all PACTOR-II and PACTRO-II-FEC systems
- Automatic message type detection (ITA-2, ITA-5 and sync/async, LSB/MSB for STANAG and MIL-STD modes
- Bit correlation analysis. Raw FSK analysis - graphical display of demodulated data on a raster time line. For visual recognition of character and block lengths
- Bit length analysis. Graphical display of demodulated data, with automatic calculation of bit length and bit pattern display
- Code check for PSK, FSK, MFSK and MIL-STANAG modes
- Manual measurement of the frequency shift(s) with movable cursors
- Oscilloscope, real time, resolution up to 200 us/div
- MFSK analysis graphical display of MFSK tone spectrum with histogram
- Phase plane analysis HF BPSK, QPSK, OQPSK, DPSK and I/Q 10-2400 Baud
- Phase plane analysis VHF/UHF-DIR BPSK, DPSK, QPSK and OQPSK 100-12000 Baud
- Phase plane analysis VHF/UHF-SUB BPSK, QPSK, OQPSK, DPSK and I/Q 50-4000 Baud
- Real-time FFT, averaging: 1-64 values, bandwidth 0.5, 1, 2, 4, 24, 48 kHz and 96 kHz and adjustable cursors, 20 frames/sec
- Sonagram and FFT tuning display
- Sonagram, real-time display with cursor functions and history (full scrolling)
- Graphical data display for selcal signal analysis
- Waterfall, real-time display with cursor functions
- Sound card calibration tool

Overall Software Characteristics

- Media Player/Recorder, recording and playback of signals
- ALARM MONITOR, automatically detected text-string saving to HD or network SMS output
- Automatic insertion of time stamps
- Synchronized PSK and FSK raw bitstream available through remote control interface
- File formats TXT, JPG, BMP, Unicode, WAVECOM (with timestamps)
- PSK, FSK and MFSK baudrate history display with full graphical recall, averaging and cursor functions
- FSK shift history display with graphical recall, averaging and cursor functions
- Configurable message type for most MIL-STD and STANAG codes
- Pass-band filters in most modes
- Pass-band tuning in FFT display in most modes
- SERIAL LINK, serial data output to PC serial interface COM 1 - 16
- STANAG5066 parser in MIL-STD and STANAG codes
- TCP/IP direct data (IQ and PCM) interface for streaming and for digital receivers (PXGF, IP-CONF, VITA-49)
- TCP/IP remote control with Wavecom GUI, full functionality over LAN or Internet (encrypted and speed optimized)
- Unlimited scroll-back buffers for text and graphics
- Up to 8 decoders may be installed in one host PC
- WiNRadio VSC and Virtual Audio Cable (VAC) support
- Sound card input, 8-bit and 16-bit, 8 kHz to 192 kHz, stereo and mono left/right
- USB-license-dongle
- WAV files playback and decoding, loop mode
- XML Remote Control Interface API for C++ and C#, XML over TCP/IP

Software Release V 8.1.00

- New mode: NXDN with demodulated bitstream (symbol) output
- All VHF/UHF DIR (directly modulated) and VHF/UHF SUB (indirectly modulated) modes are identically handled by Classifier and Classifier Code Check (CCC) and voice classification in VHF/UHF modes is fully supported
- STANAG-4285 decoder now offers a demodulated symbol output for further analysis with Wavecom's W-BitView Tool
- STANAG 4285 center frequency search extended to +/-160 Hz and various significant improvements
- „IAS Bitstream Output" renamed to „Demodulated Bitstream Output"
- General improvements and bug-fixes

Ordering Information

Product designation	WCODE
Documentation and online help	English user manual
Software and signal samples	Installation DVD with the latest software version
Updates	Software update by DVD
Prices	http://www.wavecom.ch/quotes.htm

System Requirements

	Minimum	Recommended
CPU	P4 Dual-Core 2.4 GHz	Core i5 or Core i7 2.8 GHz
Memory	2 GB RAM	4 - 8 GB RAM
OS	Windows XP	Windows 7 32-bit or Windows 7 64-bit

WAVECOM Products

• W-CODE	• W-PCIe-LAN	• W-BitView
• W-PCIe	• W-Classifier-NB	• W-SAT-email-Decoder
• W-PCI	• W-Classifier-WB	• W-Signal-Library

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